Abstract

Weighted Unranked Tree Automata over Tree Valuation Monoids
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Quantitative aspects of systems, like the maximal consumption of resources, can be modeled by weighted automata. The usual approach is to weight transitions with elements of a semiring and to define the behavior of the weighted automaton by mul- tiplying the transition weights along a run. In this thesis, we define and investigate a new class of weighted automata over unranked trees which are defined over valuation monoids. By turning to valuation monoids we use a more general cost model: the weight of a run is now determined by a global valuation function. Besides the binary cost functions implementable via semirings, valuation functions enable us to cope with average and discounting. We first investigate the supports of weighted unranked tree automata over valuation monoids, i.e., the languages of all words which are evalu- ated to a non-zero value. We will furthermore consider the support of several other weighted automata models over different structures, like words and ranked trees. Next we prove a Nivat-like theorem for the new weighted unranked tree automata. More- over, we give a logical characterization for them. We show that weighted unranked tree automata are expressively equivalent to a weighted MSO logic for unranked trees. This solves an open problem posed by Droste and Vogler. Finally, we present a Kleene- type result for weighted ranked tree automata over valuation monoids.

Keywords

weighted tree automata, weighed MSO logic, weighted rational expressions, unranked trees, ranked trees, valuation monoids